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In the Light of General Medical Progress

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Whatever is due to the Medical Department of the United States Army for its achievement during the recent war may be credited to the training and experience of its regular personnel, on the administrative side, and to the generous and efficient cooperation of the physicians and surgeons of this country, on the professional side. When we entered upon this war, every military man in the country realized that we were unprepared for it. Not that the possibility of getting into a war of such dimensions had been ignored by officers of the Army, who in fact, with but small encouragement, had done everything humanly possible to be ready for the emergency; but the fact has developed that every modern war of magnitude requires national as well as military mobilization. When we got into the European war, every one was made to realize that the whole nation was at war, as had been true of all the countries then engaged in the tremendous struggle.

To be unprepared for war, under any conditions of space or time, seems to be the chronic state and fate of all republics and democracies, from Athens down. Anglo-Saxons, familiar with the dubious policy of "muddling through," are prone to regard this condition with cheerful cynicism, as a racial or national trait. But there is a sentence of the great Napoleon which sheds light on the matter, drawn as it was from an experience with military affairs unparalleled in history. "Three fourths of mankind," Napoleon said,

* Fourth Mary Scott Newbold Lecture, read before the College of Physicians of Philadelphia, Feb. 4, 1921.

"never do the necessary things until occasion arises, and just then it is too late." Human nature, in other words, is little inclined to put restraint upon itself and go through what seems tedious and disagreeable to attain an important end, except under compulsion, through training and discipline, or under stress of impending emergency, when, as Napoleon observed, it is usually too late. Left to themselves, our children would scarcely acquire any education worth considering. We owe that to the schoolteacher. And so it is with nations, once defined by an eminent statesman as "great simple-minded children." What scientific men have told us about crowd psychology and group psychology will but confirm this view, that even large nations, without the self-direction and self-discipline that comes from training, may be, in wartime, like helpless, defenseless children. Like the Athenians, we, too, have prided ourselves on our democratic mode of government, that "in election to public offices we consider neither class nor rank," that "we stand chiefly in fear to transgress against the public and are obedient to those who are for the time in office," that in war, "we trust not to secret preparation and deceit, but to our own courage in action." In the great war we have just passed through, our men in the trenches gallantly sustained the reputation of the American soldier. Our troops first got into mass action on the morning of May 28, 1918. Less than six months later, our share of the work was over. The proverbial luck of young nations was with us. But fortune is uncertain, and it behooves us to be more wary as we grow older. I hope to show, in this brief sketch, that, for the medical profession at least, war has been a very efficient schoolmaster.

MEDICAL ADMINISTRATION

On the side of medical administration, we entered the European war with much better preparation than had been the lot of our forces in either the Civil War or the Spanish-American War. Our memorable experience with typhoid fever during the Spanish-American War taught its lesson and pointed a useful moral. The lesson was the old and often reiterated lesson of the past, that infectious diseases are more dangerous to fighting armies than the bullets of the enemy. The moral was that what is called medical administration in

armies must be permitted to work untrammelled, with the generous support of both the medical profession and the line of the army itself, if we are to operate against these diseases with the same efficiency that well-trained military forces operate against the enemy. When, at the close of the Spanish-American War, the lengthy investigation of the Dodge Commission explored the causes and prescribed the remedies for our deficiencies in medicomilitary administration, the matter was taken very seriously to heart by the late Gen. Robert M. O'Reilly, who devoted his whole administrative period as Surgeon-General of the Army to correcting these defects and to doing his uttermost to make our Medical Corps a highly efficient military machine.

Not to take up time with all the recommendations of the Dodge Commission, I will briefly say that what an army mainly requires, in peace or war, is personnel and material supplies, including food and shelter. With adequate equipment and efficient personnel, almost anything can be accomplished. On the side of matériel, General O'Reilly enabled us to equip our field hospitals and sanitary organizations more rapidly than they could be organized as to personnel. On the side of personnel, he created the Medical Reserve Corps, through which device the Medical Department acquired over 30,000 officers from the civilian profession for the recent war. In such matters as the introduction of antityphoid vaccination and the aid given to Professor Chittenden of Yale, in his experiments on the physiologic economy of nutrition, General O'Reilly upheld one of the time-honored traditions of the Army Medical Department from the days of Beaumont down, namely, the encouragement of scientific research.

When we entered the European war, our army existed mainly on paper, as "tables of organization," blank forms to be filled in as to personnel and matériel on occasion. In the Texan mobilization we had, for the first time since the Civil War, a mobilized division in the field. This required the organization of certain sanitary field units, and these detached nuclei proved to be starting points for the development of the complex system of sanitary formations required in the World War. As a result of the recommendations of the Dodge Commission, a full year's supply of medicines, hospital appointments and nonperishable stores, ade-

quate for an army of about 300,000 men, had been accumulated and laid by; and fifty base hospital units had been organized by the civilian profession in different cities, through the Red Cross, and under direction of Col. Jefferson R. Kean.

On our entry into the war, then, we had already a fair start in the matter of equipment and medical supplies, for which Congress subsequently appropriated more than half a billion dollars for the use of the Medical Department during the war period. Largely through the mobilization of the Medical Reserve Corps, the personnel of the Medical Corps was increased by Nov. 30, 1918, to 30,591 medical officers, and 264,181 enlisted men, an organization one and one-third times the size of the whole Regular Army of Jan. 1, 1917. The commissioned Ambulance Service was increased from zero to 209, the commissioned Veterinary Corps from 62 to 2,002, the commissioned Dental Corps from 86 to 5,937, the commissioned Sanitary Corps from zero to 2,919, the Army Nurse Corps from 403 to 21,480. The Surgeon-General's Office at Washington, which, on April 6, 1917, consisted of the Surgeon-General, his staff of six officers and 149 civilian employees, became, at the height of the war period, an organization of thirty administrative units, with a personnel of 262 medical officers and 1,889 civilians. Yet, the total expenditures of the Medical Department up to April 30, 1919 (\$314,544,000), were two hundred million dollars less than the actual appropriation for supplies, and only 2.2 per cent. of the total expenditures of the entire Army.

CARREL-DAKIN TREATMENT

Thus, by the time our troops got into active operations, we had the sinews of war, supplies and personnel, and the additional advantage of the sanitary experience already gained by our allies at the front. As you know, this was the first war in history in which the mortality from battle casualties exceeded that from communicable diseases. The first and most important changes in military surgery were therefore centered on wound treatment. In 1914, operative surgery was entirely aseptic. But, with the dirt and grime of trench warfare, over ground cultivated for centuries, and therefore swarming with pathogenic organisms, asepsis was no longer possible and the revival of the antiseptic

surgery of Lister was almost a foregone conclusion. As described by Crile:¹

The early states of wound treatment on the Western Front were haphazard and experimental, a matter of dispute between "the claims of the value of various chemical agents against those of no chemical agent, of moist dressings against dry; of hot against cold; of frequent dressings against infrequent, and of no dressings against both; of sunlight and of electric light against occlusions; of immersion against hot air; of bacteriological control against clinical judgment; of vaccines, toxins and foreign proteins against normal reaction; of wound inoculation with harmless organisms against wound sterilization; of isotonic against hypertonic solutions; paste has competed with paste, bipp with ip; sap with both and chromic pastes with all."

Out of all this controversy and welter of opinions, there was at last evolved one of the great surgical discoveries of the war, the application to wound treatment of the principle of disinfection by the release of a gas from a liquid solution. Of this method, the Carrel-Dakin, Finney² says conclusively that "it is one of the most important and far-reaching contributions of the war to the armamentarium of the surgeon." As Keen³ says:

Lister taught us, above all, how to prevent infection; Dakin and Carrel, following Lister's principles, have taught us how to conquer even rampant infection. For nearly half a century we surgeons have been fighting firmly entrenched infection, but always in vain. It required the stern stimulus of war to enable us to win the victory.

Now, although the physicochemical principle involved was familiar to us in ordinary commercial chlorid of lime sterilization or in antiseptic throat pastils, the Carrel-Dakin method had a long foreground and thereby hangs a tale. In his Mütter lecture, delivered before this College in 1902, the late Col. Louis A. La Garde demonstrated that the pathogenic organisms in powder or on projectiles are not destroyed by the heat of firing but are carried directly into the wound. We have to reckon, then, with the fact that there is no such thing as a sterile battle wound. Now, the wounds

1. Crile, G. W.: Tr. Am. Surg. Assn., Philadelphia **37**: 35, 1919.

2. Finney, J. M. T.: Tr. Cong. Am. Phys. & Surg., New Haven, **11**: 15.

3. Keen, W. W.: The Treatment of War Wounds, Ed. 2, Philadelphia, 1918, p. 75.

from high explosive shells and other great missiles used in this war differed from those of any other war, not only in the frightful laceration of the tissues, but in the fact that the whirling, vibratory motion of the projectile completely devitalized such tissues, converting them into ideal culture mediums for the pathogenic micro-organisms carried into them. In the first year of the war, the base hospitals were full of such septic wounds, which had developed during the time required to transport the wounded back to base for treatment. Necessity is the mother of invention, and the necessity for the Carrel-Dakin treatment was created by a military principle. That principle was the rapid evacuation of the wounded from the firing line, with the utilitarian nonmedical aim of relieving the fighting forces of encumbrance and of returning those recovered from wounds to the firing line as soon as practicable. As humanitarian physicians, it grieved us to see our soldiers die from septic wounds, and it was our bounden ethical duty to save their lives; but as military officers, we could not afford to let them die, for the issue, at the time, was uncertain, and the odds were tremendous. To make this great salvage service efficient and effective, centers of triage were established and surgical service was pushed up to the front, so that the Carrel tubes could be inserted in the wounds before evacuation to the rear. The effect on wound treatment was miraculous. Part of Carrel's treatment was the mechanical cleansing and removal of débris and of loose devitalized tissues from the wound. From this, it was but a step to débridement, or complete excision of the devitalized tissues by the knife, a kind of mechanical asepsis evolved by Gale and Lemaitre. Of 206 gunshot wounds treated in this way in Evacuation Hospital No. 2, Colonel Brewer records that 93.5 per cent. healed without infection or suppuration. It was these two principles of wound treatment which enabled us to return such large percentages of our wounded to the front for duty. Of the advantages which were ours in this respect, Brewer ⁴ has spoken forcibly:

It was fortunate for our men that we did not have to go through these two or three years of experimental work where so many died and so many suffered intensely, and where the

4. Brewer, G. E.: *Monthly Bull.*, Chamber of Commerce, New York 10: 40-41, 1919.

results were so unfortunate. We were able to begin where they left off, and it is to the hearty and cordial cooperation of the French and British medical services that we owe this. Our men, as soon as they came over, our splendid surgeons that volunteered in such large numbers at the beginning of the war, were taken in by the French and British surgeons, given work to do, and everything possible was done to facilitate their work. As a result of that, last January when our forces began to go into the lines, and we established our advanced evacuation hospitals, we were able to employ surgical teams of not only some of America's most distinguished surgeons, but of those who had the inestimable advantage of having worked with the masters of surgery of the French and British armies.

I have dilated on these methods at the start, because we may not enjoy this advantage a second time, and because these surgical principles, the most important which came out of the war, need not be lost to civil surgery, but may indeed be of the highest practical value in industrial and railway surgery. The rest of our war surgery, even the orthopedic and maxillofacial, was mainly an extension of principles already well established.

PROBLEMS OF TRANSPORTATION AND TREATMENT

We sailed for France with General Pershing, May 28, 1917. The first duty of the Medical Department was to provide ways and means for hospitalization of the sick and wounded. This was a long and tedious process, never fully realized, but in process of realization at the end of the war, when our program was for 500,000 beds. May 15, 1918, thirteen days before our First Division captured Cantigny, there were 30,187 hospital beds available. On the signing of the armistice (Nov. 11, 1918), we had available in France for an army of a mean total strength of nearly two millions, 261,403 beds, in 153 base hospitals, 66 camp hospitals and 12 convalescent camps. The total number of patients in hospital on that day was 193,448, of whom 94,405 were sick, and 99,043 wounded. The total number of beds in the home territory was 121,883, with 69,926 patients, or a grand total of 353,887 hospital beds in France and the United States, as against a maximum of 118,057 beds for the Union forces in the Civil War. Most of the large hospital centers in France, such as Allerey, Bazoilles, Toul, Mesves, Mars and Savenay, were made up of units of 1,000 bed

hospitals, barrack type, with a crisis expansion of 2,000, so that the total bed capacity of the centers was ultimately to be from 10,000 to 40,000. One of the centers had 22,500 patients when the armistice was signed. Through the courtesy of the French authorities, many separate buildings were acquired, such as the *casernes* at the Toul center (15,000 beds) or the hotels at the Vichy center (10,000 beds). Hospital construction in France was done by our Corps of Engineers, who had even to cut the timber and saw the lumber.

Although the humanitarian element in evacuation of the wounded is subordinated to its military purpose, yet the wounded soldier's chances of recovery are better furthered by business efficiency and military promptitude in evacuation than by misdirected sentiment or wrong-headed philanthropy. The underlying military motive is kindlier than the ancient or Turkish plan of having no medical administration in campaign whatever, leaving the wounded to die in their tracks. There were physicians who complained that they were utilized as packing clerks at the front, but it is just this sort of administration which brings the wounded man safely into the hospital, with a clear statement of the nature of his injury. Evacuation on the Western Front was a complex and sometimes desperate matter, often hampered by lack of transportation facilities, by the impassable condition of roads boggy with mud or crowded with other vehicles, and by the generally torn up condition of the combat areas. It required the prompt mobilization of every kind of vehicle, such as ambulances, motor trucks, lorries and other rolling stock attached to the sanitary formations which move forward with the fighting divisions, as well as the establishment of evacuation hospitals and rest stations on the line of communications and of base hospitals and convalescent camps in the zone of the interior, with their own type of transportation, including ambulance service, hospital trains, hospital barges and hospital ships. In spite of delays in construction, we had, on Nov. 11, 1918, twenty-one hospital trains of sixteen coaches each, about sixty hospital barges, and some 7,375 ambulances of heavy and lighter type. Up to Nov. 11, 1918, 129,997 sick and wounded had been evacuated by our hospital trains, and 197,708 in the fifty trains lent by the French, while from the embarkation ports there

were evacuated by ship to the United States 15,853 patients up to Nov. 11, 1918, and 83,642 up to March 1, 1919.

To the sanitary administration on the Western Front, in other words, to the military application of preventive medicine, was due our relatively small disease incidence as compared with earlier wars, and this in spite of the long period of exposure before our troops got into action. The management of the sick and wounded records, the services of epidemiology, laboratories, food inspection and food economics, sanitary inspection and venereal prophylaxis were of the highest order of efficiency, and with these services the names of Siler, Zinsser, Emerson, Young, Keyes, Walker, in the war zone, and of Reynolds, Howard, Chamberlain and Russell in the home zone, will always be associated. In spite of repeated cabling we never got all the personnel and supplies needed in crucial situations, which had to be met and eked out by robbing one organization to supply another, and by the self-sacrificing full-time and overtime service of operating surgeons, nurses and hospital personnel. Many hospital nurses worked from fourteen to eighteen hours daily for several weeks running. Some surgeons worked from forty-eight to seventy-two hours without sleep. One roentgenologist dropped unconscious by his machine after operating it for forty-eight hours. Litter-bearers were sometimes so exhausted that they could not lift their hands above their heads. Promotions recommended for deserving medical officers were held up indefinitely, and did not reach them overseas until the cessation of hostilities, when they were, in the Napoleonic phrase, too late.

RESULTS

So much for the means at our disposal. The results attained in hospital treatment were remarkable. Of the 2,039,329 men who reported in France, about 1,300,000 were combatant troops; and of these, twenty-eight divisions, or about 784,000 men, got into action. Our total casualties were 318,993, of which number 34,249 were killed in action, 50,714 died from disease, and 13,691 (6.11 per cent.) died from wounds out of 224,089 wounded, of whom 158,595, or 70.77 per cent., were returned to duty. We can best appreciate the advances made in wound treatment and the therapeutics of disease by comparing our results in hospital with

those of the Civil War. Although our maximum total strength in the World War on Oct. 11, 1918 (3,551,447) was nearly four times greater than that of the Union forces on Jan. 1, 1863 (914,447), yet, covering the same relative period of time, 44,238 men (14.5 per thousand) were killed in action in the Civil War as against 34,249 (11.26 per thousand) of our troops in the World War; 246,712 (80.87 per thousand) wounded were treated in hospital in the Civil War, 224,089 (73.66 per thousand) in the World War; 31,978 (10.48 per thousand) died from wounds in the Civil War, 13,691 (4.5 per thousand) in the World War; 186,216 (61.04 per thousand) died from effects of diseases in the Civil War, and 50,714 (16.67 per thousand) in the World War. Thus, although the Union Army of the first two years of the Civil War was one-fourth the size of our mobilization in the World War, nearly 10,000 more men were killed outright in the Civil War, more than 22,000 more men were wounded, more than twice as many died from wounds in hospitals, and nearly four times as many died from the effects of disease.

As given by Lieut.-Gen. von Schjerning, the total losses of the German Army during the four years of the World War, with a mean average strength of 4,257,720, were 1,531,048 killed in battle, 4,211,269 wounded, and 155,013 died of disease out of 19,461,265 admissions to hospital. As given by General Sir John Goodwin, the total losses of the British army, exclusive of the Indian and African troops, were 569,143 killed in action, 170,509 died from wounds, 83,975 died from other causes, 1,025,808 wounded, and 143 missing. Including the Indian and African contingents, the total losses, including 929,812 deaths from all causes, 2,097,994 wounded and 3,467 missing, amounted to 3,051,273.

Judging from our own figures, and considering the terrible effects of heavy artillery and high-power explosives, our capacity to heal wounds has increased twofold and our ability to treat disease fourfold. We can form no judgments from the German figures, because they have not yet given the numbers who have died or recovered from battle wounds, while their figures of nearly twenty million admissions to hospital are not the same thing as the actual number

of patients admitted. In ability to prevent disease we have made gigantic strides since the Civil War. Between Sept. 1, 1917, and May 2, 1919, we had 213 deaths from typhoid fever; had the Civil War rate obtained, we should have had 51,133 deaths, and had the Spanish-American War death rate obtained, 68,164. We had thirteen deaths from malarial fever in the World War; with the Civil War death rate, we should have had 13,591, and with the Spanish-American War rate, 11,317 deaths. In the World War we lost only forty-two men from dysentery; with the Civil War rate, we should have lost 63,898, and with the Spanish-American War rate, 6,382. Our mortality from tuberculosis in the World War was 1,220; with the Civil War death rate, it would have been 9,574. We lost only five men from smallpox in the World War, but with the Civil War death rate we should have lost 9,536. On the other hand, 41,747 soldiers died from pneumonia in the World War, while with the Civil War death rate this mortality would have been 38,962, and with the Spanish-American War death rate, 6,086. The high mortality in the World War is to be explained by the unusual malignancy of the pneumonias following the measles epidemic of 1917-1918 and the great influenza epidemic of 1918-1919. The most difficult problem facing both military and civil sanitarians is the prevention of the sputum-borne infections.

Our success in wound treatment was due to the high efficiency and promptitude of our surgical service in carrying out the Carrel-Dakin treatment and the method of wound excision with primary suture. The highest incidence of war wounds in our hospitals occurred during October, 1918, the period of the Argonne fighting, when 38.37 per cent. of admissions to hospital and 41.52 per cent. of deaths were from gunshot and other wounds. Our percentages of admissions and deaths from gunshot wounds, during our entire six months of fighting, were 33.42 and 54.29, respectively. Wounds from small arms and those incurred during air attacks had a higher case mortality than wounds from missiles, while recovery was the rule in cases of gassing. The case mortality from gunshot wounds was 8.26 per cent., that from gassing 1.73 per cent. Wounds from missiles were most frequent in the lower and upper extremities and the chest, being sustained in going over

the top. The percentages of admissions and deaths from wounds of the lower extremities were about equal.

More men were killed outright through abdominal and pelvic injuries than through any other. More than twice as many were killed through head injuries as were admitted to hospital, and nearly seven times as many through wounds of the spine, abdomen or pelvis. All this is to be explained by the terrible mangling of the body from high explosive shells and projectiles of large caliber. Wounds of the spleen, intestine, pancreas, stomach, kidney, liver, esophagus and bladder show the highest case mortality, in the order named, both in the World War and in the Civil War. Men thus wounded seldom recovered, because the destruction of these viscera was beyond the reach of surgery; but although visceral wounds were almost hopeless in both wars, we have astonishing evidences of improvement in the treatment of gunshot fractures in the World War.

The comparative percentages of case mortalities in the Civil War and the World War are for gunshot fractures of the tibia and fibula as 26.19 to 13.74; of the humerus as 20.70 to 9.04; of the clavicle and scapula as 13.90 to 6.98; of the radius and ulna as 9.40 to 3.98; of the wrist as 12.10 to 1.80, and of the foot as 7.70 to 2.77.

CASUALTIES

The number of casualties among our medical officers in France from July 1, 1917, to March 13, 1919, was 442, and of these, 46 were killed in action, 4 were lost at sea, 212 were wounded, 22 died of wounds, 101 died of disease, 9 died of accidents, and 7 were reported missing in action. While our infantry sustained the greatest number of casualties, namely, 215.66 per thousand wounded, and 12.77 per thousand killed in action, the Medical Corps comes sixth on the roll of honor, following the artillery with 25.67 per thousand wounded in action and 1.62 per thousand killed. That the number of killed and wounded in our Medical Corps (258) is more than one half of its total casualties (442), and that the number who died from disease (101) is almost one fourth, is sufficient evidence of the readiness with which our medical officers exposed themselves to fire and ran the risks of infection in hos-

pital. The first American soldier who was killed in France after our entry into the war was a medical officer, Lieut. William T. Fitzsimons, whose life was lost during an air attack on the base hospital group at Dannes Camiers, Sept. 4, 1917, and in honor of whom our Army General Hospital at Denver has just been named the Fitzsimons General Hospital.

PREVENTION AND TREATMENT IN HOME TERRITORY

In the home territory, excellent administrative work was done from the start in the all-important matter of raising personnel and supplies, and in providing adequate hospitalization and sanitation for our thirty-two army camps, some of which were great communities of between 40,000 and 50,000 population. The purchase of vast quantities of supplies, some of which had to be manufactured on a large scale for the first time in this country, the distribution and shipping of such supplies through supply depots, and the financial accounting for these was a large achievement, which will form an important chapter of our Medical History of the War. Some of the camps were badly chosen as to site, and the base hospitals in many of these camps were the last structures to be put up, so that division surgeons and the commanding officers of these camp hospitals had an up-hill fight of it during the measles and meningitis epidemics of the severe winter of 1917-1918, and even more arduous experiences with the epidemic of Spanish influenza of 1918-1919. In this war, we first learned to go after the sources of disease instead of waiting for it, through a gradual realization of the fact that the individual, particularly the individual carrier, is more dangerous than the disease itself. The isolation of contacts and suspects, as well as of carriers, in such communicable diseases as measles, meningitis and influenza, although not a new feature in military or civil sanitation, was first carried out on a large scale in this war.

The Division of Sanitation in the Surgeon-General's Office had work of the most varied kind, from the extermination of mosquitoes to the preparation of our statistical records. This part of our service profited much by the experience and wise counsel of such experts as Welch, Vaughan, Zinsser and Emerson, and it is no exaggeration to say that those who served with

us acquired fresh ideals of group sanitation and group medicine through actual contact and experience with the hygienic requirements of large military communities, under constant discipline and of uniform type. Food inspection and food economics were administered from the point of view of modern nutritional science by expert metabolists. The administration of our surgical service was greatly forwarded by the work of such men as Charles and William Mayo, Finney, Brackett, Cushing, Goldthwait, Crile and Brewer; our medical service by Thayer, Janeway, Longcope and Conner; the service of ophthalmology by Greenwood, deSchweinitz, Wilmer and Black; the service of otolaryngology by MacKernon, Mosher and Richardson. Reconstruction, gas defense, the physiologic requirements in aviation and the psychologic examination of drafted men come up as entirely new subjects in military administration. Although the orthopedic or instrumental phase of reconstructural surgery of disabled soldiers had been blocked out in Germany ten years before the war and practiced here and there in civil life, the program was soon expanded to include reeducation, or the vocational training of the disabled, including the blind and the deaf; rehabilitation, or the social adjustment of the disabled to suitable employment, and the education of the public to a proper attitude toward the crippled soldier, as voiced in the utterance of Michael Dowling, a reconstructed civilian, at the session of the American Medical Association in 1918:

Every community and every family ought to see to it that every other member of the family pays no attention to a hunchback, never looks at a man with clubfoot as he walks down the street, especially never looks at his deformity, and never looks at a man with a peg leg or with an empty coat sleeve. It should be taught in the schools. It should be preached from the pulpits.

With this phase of administration we associate the names of Frank Billings, Richardson and Wood.

The application of the newer findings of psychology, neurology and psychiatry to the examination of drafted men by Salmon, Bailey and Yerkes demonstrated the existence in our recent population of large numbers of people with weak, undeveloped or disordered minds. Mental tests of children had been employed in the schools, but they were first tried out on adults in mass

during our recent mobilization. Mental defectives will be bad risks in any future army. The soldier of the future must be of active mind as well as body. His wits and senses must be something better than a baseball player's. Under the recent program our prospective army will be a school in which the mind and the senses are trained to coordination through vocational adaptation to suitable employments. Although we were engaged less than twenty months in the war, the scientific achievement of our medical officers in that short time was considerable. What was accomplished reflects the highest credit on our American profession. Through the labors of MacCallum, Cole, Dochez, Avery, Bull, Miller, Capps and Irons, the pneumonias consequent upon different infections were studied pathologically and typed as to bacilli. *Streptococcus hemolyticus* infection was investigated by Avery, Kinsella and Swift; the surgical aspect of the empyemas by Dunham, Bell, Graham, Kinsella and Stevens, of the Empyema Commission of the U. S. Army; measles by Sellards, Bigelow and Fox; meningitis by Flexner and Herrick; influenza by Cole, Avery and Jacobs; parotitis by Sailer; bronchopneumonia by Miller; tuberculosis by Bushnell; anthrax by Pearce; erysipelas by Kana-vel; arthritis by Pemberton, and parasitic infections by Kofoid. The hypothesis that trench fever is a louse-borne infection, which originated with the British commission under General Sir David Bruce, was carried to successful demonstration by the American commission under Richard P. Strong.

Generally speaking, the prevention and treatment of disease was of greatest moment in our camps in the home territory, while the transportation and treatment of the wounded occupied us mainly in the war zone. I have already spoken of the relation of the concept of transportability to successful wound treatment. On the Western Front, this was vastly forwarded by the adoption of the principle of continuous extension by means of the Thomas and Hodgen splints and the Balkan frame. Of outstanding practical importance was the work of Blake, Goldthwaite, Osgood, Allison and Keller on gunshot fractures and the standardization of splints. My time limits prevent more than passing mention of the brilliant work of Cannon, Porter and Crile on wound shock; of Cushing on brain surgery; of Hayes, Hutchinson, Powers and Blair on

maxillofacial surgery; of Yates and Lilienthal on surgery of the chest; of Salmon on war neuroses; of Warthin, Winternitz and Underhill on the pathology of war gas poisoning.

EDUCATION AND TRAINING

On the score of training, instruction was given to volunteer medical officers in all branches of military medicine and surgery at the Medical Officers' Training Camps in this country, at the Rockefeller Institute, at the Army School at Langres, in the special courses instituted by the administrative divisions of the Surgeon-General's Office in our larger cities, and through the generous cooperation of such great leaders as Sir Robert Jones in England and Depage at La Panne (Belgium). Our Medical Officers' Training Camps brought out some defects in medical education in this country and, on the administrative side, the most valuable lessons which our army has learned from the European war have been in this matter of education and training. From the great training areas in France came the idea of training in corps areas in this country; from the training camps in this country we have learned that medicomilitary or other training should not be too generalized as to subjects or too extended as to time, but should be concentrated on particulars of immediate practical importance. From the useful and valuable lists of the qualifications of civilian practitioners furnished us by the American Medical Association and the Council of National Defense during the mobilization of the Medical Reserve Corps, we have learned the value of cooperation with the medical profession in relation to any future mobilization for war. The expensive and valuable scientific work done for the Army by the Rockefeller Institute, the Carnegie Institution of Washington, the National Research Council and the Public Health Service is a guarantee of the cooperation and team-work which the government may hope for in any future emergency.

PROGRAM FOR THE FUTURE

I have now endeavored to tell you, in brief space, what the Army Medical Department and the medical profession of the country have accomplished in the recent war. A word as to the future. It is the purpose of our army establishment to make its future program

of training educational in the broadest sense. Modern armies require not only fighting men but also skilled mechanics, artisans and craftsmen of all kinds. In future, the Army proposes to train such men within the ranks. This is one of the most important things that has come out of our experience in the European war. Hereafter, the enlisted man will have full opportunity to learn a trade and to join the ranks of skilled workers in the world. If he belongs to the unskilled classes, when he leaves the Army, it will be his own fault. If he accepts his Army training in the right spirit, he will acquire a definite means of acquiring a livelihood, of supporting a family and of becoming a respectable and useful member of society. As blocked out on the Army job sheets, this training will be intensive and scientific, not the haphazard and ill-considered training which the journeyman plumber's or steam-fitter's apprentice too frequently gets from the boss. In like manner, it is incumbent on the Medical Department not merely to institute educational training of enlisted men as clinical clerks and surgical dressers in the hospital, but also to train specialists among our commissioned personnel in all the important branches of scientific medicine. In the medical establishment of the British Army, steps have already been taken in this direction by the appointment of whole-time chiefs of surgery and pathology. In the contemplated enlargement of the Walter Reed Hospital, we shall have an establishment at which this program can be carried out by our Army Medical School in full measure. The older, archaic army of the small, scattered and isolated posts disappeared with the European war. A newer army, of large corps area, has taken its place. I think you will admit that a nation of more than a hundred million people needs such an army, and that its medical department should have educational facilities at least comparable with those of Netley and Val de Grâce.

In pleading the case of American liberties before the English Parliament in 1775, Edmund Burke said:

It is the love of the people; it is their attachment to their government, from the sense of the deep stake which they have in such a glorious institution, which gives you your army and your navy and infuses into both that liberal obedience, without which your army would be a base rabble, and your navy nothing but rotten timbers.

This great idea has been borne in upon us through our experience in the European war. Our reasoning in regard to training and education is the same. We came out of the people; we went to the people for our personnel, and we want to do something in return for their sons while they are with us. We of the Medical Corps came out of the medical profession; it is our desire to keep in closest touch with the profession, working together, in the future as in the past, for the common good of our country. I ask you to consider, for a moment, the history of our Medical Corps in its relation to the American profession.

CONCLUSION

William Beaumont started experimental physiology in this country, Woodward photomicrography, Sternberg bacteriology, Billings advanced hospital construction, medical bibliography, medical statistics and the science of medical librarianship. While on duty in the Army during the Civil War, Weir Mitchell developed the science of the peripheral nerve lesions, which was the foundation of his work in neurology. Even your great anatomist, Joseph Leidy, did valuable postmortem work in our military hospitals during this period. After working under Welch at Johns Hopkins, Walter Reed, with his associates in Cuba, demonstrated the transmission of yellow fever by mosquitos, and (with Vaughan and Shakespeare) of typhoid fever by flies. Gorgas then cleaned up Havana and Panama, and made the Isthmus habitable. Russell introduced preventive vaccination against typhoid fever on a large scale; Hoff vaccinated the Porto Rican population and rid the island of smallpox and leprosy. In tropical medicine, I need only mention the work of Ashford on hookworm infection and tropical sprue, Craig on malarial fever and the parasitic amebas, Ashburn and Craig on filaria and dengue, Vedder on beriberi and amebic dysentery, Chamberlain on hookworm infection and beriberi, Gentry and Ferenbaugh on Malta fever and Whitmore on dysentery and yellow fever.

Since the close of the war, there has been apparent a certain feeling of bitterness against the Army. It is due in part to losses sustained, whether of relatives killed in battle or of income or of business advantages, to disappointments and disillusion, to the fact that modern

warfare is a drier, more businesslike and less romantic enterprise than the wars of old, and to the natural distaste of average civilized humanity for a thing so disagreeable and troublesome as war. In general, it is a symptom of what Cushing calls "war weariness;" yet I myself believe that it is more common among those whose lot it was to chafe at the leash while doing their bit in the home territory than among those who served with us in France. Pacifists maintain that wars are avoidable things, by which they probably mean that civilized man, i. e., man tamed and domesticated, would like to avoid them if he could. The European war resembled the great epidemics of the middle ages, which came suddenly down upon humanity, they knew not whence or where, with terrible death-dealing force. Epidemics and wars, as Crookshank points out, are not of simple, but of multiple or complex causation. The epidemic of influenza that followed this war was in reality far more destructive; yet who has succeeded in explaining, or even in exploring its causation? Crookshank believes that the remote causes of this epidemic are beyond human calculation. Wars, then, may some day perhaps be prevented, when there exist statesmen with genius and ability sufficient to prevent them. The business of armies, however, is to maintain peace in time of peace and to be ready for war whenever the defense of their country requires it. For the "never again" school there is only one answer, namely, that defenseless nations, like defenseless individuals, invite not only attack but also invasion of their territory. As Crookshank puts it, "until war and pestilence are abolished, we must initiate schemes of defense." To guarantee the defense of a modern nation, there is only one means, namely, discipline and training. In the address I quoted at the beginning, Pericles counsels the Athenians who survived the first year of the Peloponnesian War to "pray for a safer fortune," but to be no less venturously minded against the foe; not weighing the profit . . . but contemplating the power of Athens, in her constant activity; and thereby becoming enamored of her. And when she shall appear great to you, consider then that her glories were purchased by valiant men, and by men who learned their duty; by men who were sensible of dishonor when they came to act; by such men as, though they failed in their attempt, yet would not be wanting to the city

with their virtue, but made to it a most honorable contribution. . . . Be zealous, therefore, to emulate them, and judging that happiness is freedom and freedom is valor, be forward to encounter the dangers of war."

It was in this spirit that the youth of our nation met the enemy, and you may read of what they did in the report rendered to the secretary of war by their commander, General Pershing.

I ask that, as members of the medical profession, you will give to the Medical Department of the Army in time of peace the same loyal support and appreciation which you have rendered, and which we may count on you to render, in time of war.

